

**Statement of William D. Magwood, IV
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U.S. Department of Energy
Before the
Subcommittee on Energy
Committee on Science
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Chairman Biggert, Mr. Larson, and Members of the Subcommittee, it is a pleasure to be here to discuss the Fiscal Year (FY) 2005 budget submission for DOE's Office of Nuclear Energy, Science and Technology.

The program has made a great deal of progress over the past several years. From the time, not so many years ago, when it appeared that the United States might abandon advanced nuclear research and development, we have been successful in reasserting U.S. leadership in the world. Representing the United States, I have been elected by my international colleagues to serve as the chair of two important international bodies—the OECD Steering Committee on Nuclear Energy and the Generation IV International Forum. When it appeared that nuclear power's era had ended in the United States, nuclear utilities have turned their programs around, making more energy last year than at any time in history and launching into very serious discussions to explore the construction of new plants for the first time in decades.

Recent developments have been encouraging. The Department has launched the process of establishing a central laboratory for nuclear research and development—the Idaho National Laboratory. We are also exploring the possible construction of a pilot Generation IV nuclear plant at our new lab that will demonstrate highly efficient electricity production and pave the way to realize the President's vision of a future hydrogen economy.

The Department's FY 2005 request for the nuclear energy program proposes a \$410 million investment in nuclear research, development and infrastructure for the Nation's future that is designed to continue this progress. This budget request moves forward the Department's commitment to support the President's priorities to enhance the Nation's energy independence and security while enabling significant improvements in environmental quality. Our request supports development of new nuclear generation technologies and advanced energy products that provide significant improvements in sustainability, economics, safety and reliability, and proliferation and terrorism resistance.

We are committed to efficiently managing the funds we are given. We have abandoned outdated paradigms to integrate the Idaho Operations Office with our headquarters

organization, enabling us to manage our responsibilities in the field to achieve greater quality and efficiency than would otherwise be possible. We are enhancing our expertise in critical areas such as project management through training and certification of existing staff and the acquisition of experienced, proven managers. We continue to implement the President's Management Agenda (PMA) by further integrating budget and performance, improving Program Assessment Rating Tool (PART) scores for our research and development programs, and linking major program goals in the performance plans for our Senior Executives and technical staff. These improvements are challenging and time-consuming, but we feel they must be done to assure our program's ability to make the best use of the taxpayer dollars.

While we have made great progress in all these areas, much remains to be done. Our FY 2005 request moves us in the right direction and I will now provide you a full report of our activities and explain the President's request for nuclear energy in detail.

GENERATION IV NUCLEAR ENERGY SYSTEMS

Our Generation IV effort continues to make significant progress. Since the Generation IV International Forum and the Nuclear Energy Research Advisory Committee (NERAC) issued their joint report, *A Technology Roadmap for Generation IV Nuclear Energy Systems*, the members of the Forum have expanded to include Switzerland and the European Union. The now eleven members (Argentina, Brazil, Canada, the European Union, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom and the United States) have organized into interest groups associated with each of the six selected Generation IV systems and are negotiating international legal agreements to enable advanced nuclear research to be conducted on a multilateral basis.

We hope to complete these negotiations later this year and move forward with these countries to develop advanced reactor technologies for commercial deployment in the 2015 to 2030 timeframe. Generation IV concepts offer significant improvements in sustainability, proliferation resistance, physical protection, safety and economics. These advanced systems will not only be safe, economic and secure, but will also include energy conversion systems that produce valuable commodities such as hydrogen, desalinated water and process heat. These features make Generation IV reactors ideal for meeting the President's energy and environmental objectives.

As indicated in our recent report to Congress on our implementation strategy for the Generation IV program, while the Department is involved in research on several reactor concepts, our efforts and this budget proposal place priority on development of the Next Generation Nuclear Plant (NGNP). The NGNP is based on the union of the Very-High-Temperature Reactor concept in the Generation IV Roadmap with advanced electricity and hydrogen production technologies. We are exploring the potential of an international, public-private project to build and operate a pilot NGNP at the Department's Idaho site. While the Department has not made a decision to proceed with

this effort, such a project could validate the potential of this technology to contribute to meeting to goals of the President's Hydrogen Fuel Initiative. If successful, this technology could produce hydrogen at a cost that is competitive with gasoline and electricity and with advanced natural gas-fired systems.

The Idaho National Laboratory and several other labs will also explore a range of other Generation IV concepts principally the Supercritical Water-Cooled Reactor, the Gas-Cooled Fast Reactor and the Lead-Cooled Fast Reactor. Our efforts will focus on establishing technical and economic viability, and developing core and fuel designs, and advanced materials for these concepts. We are also working with our colleagues in the Office of Science to assemble a joint Future Energy Advanced Materials Initiative aimed at the development of new materials for advanced fission and fusion energy systems. The FY 2005 request enables progress on this broad front. With your support, and the leveraging of our resources with those of our international partners, we expect to make continued progress toward developing world-changing technologies.

NUCLEAR HYDROGEN INITIATIVE

Hydrogen offers significant promise as a future energy technology, particularly for the transportation sector. The use of hydrogen in transportation will reduce U.S. dependence on foreign sources of petroleum, enhancing national security. Significant progress in hydrogen combustion engines and fuel cells is making transportation using hydrogen a reality. Today, through electrolysis, we can convert water to hydrogen using electricity. We believe that for the future, Very-High-Temperature Reactors coupled with thermochemical or high-temperature electrolytic water splitting processes offer a more efficient technology for production of large quantities of hydrogen without release of greenhouse gases. The goal of the Nuclear Hydrogen Initiative is to develop economic, commercial-scale production of hydrogen using nuclear energy.

With funding of \$9 million in FY 2005, the Nuclear Hydrogen Initiative will progress toward the development and demonstration of closed, sulfur-based cycles, such as the sulfur-iodine process. These processes have been demonstrated on a bench scale at somewhat lower temperatures and pressures than would be required for economic hydrogen production, but they show considerable promise, especially when they are considered for mating to Very-High-Temperature Reactor systems. We will also explore high-temperature electrolysis, which uses electricity to split high-temperature steam into hydrogen and oxygen, similar to a fuel cell operating in reverse (specifically a solid-oxide fuel cell, SOFC). High-temperature electrolysis requires much less fundamental R&D, but the ability of the process to scale economically must be demonstrated.

Finally, a major effort will be pursued in FY 2005 to explore materials for hydrogen production processes which must endure high-temperatures and very corrosive environments while maintaining structural integrity at low costs. Included in this effort will be our work to explore new membranes that can increase the efficiencies of the hydrogen production processes.

ADVANCED FUEL CYCLE INITIATIVE

Of the issues affecting future expansion of nuclear energy in the U.S. and worldwide, none is more important or more difficult than that of dealing effectively with spent nuclear fuel. After a long and difficult process, the U.S. is moving forward with a geologic repository, and the Department is on schedule to submit a license application to the Nuclear Regulatory Commission by the end of 2004.

Research on improving ways to treat and utilize materials from spent nuclear fuel will allow the Department to optimize the first repository, and delay – and perhaps even eliminate – the need for future repositories. The Advanced Fuel Cycle Initiative, with an investment of \$46 million for FY 2005, will continue the progress made in the development of proliferation-resistant treatment and transmutation technologies that can reduce both the volume and toxicity of spent nuclear fuel. These technologies would support both national security and energy independence by reducing inventories of commercially-generated plutonium while recovering residual energy value from spent nuclear fuel. If successful, these same technologies offer benefits of enhancing national security by reducing inventories of commercially-generated plutonium and enhancing energy independence by recovering the energy value contained in spent nuclear fuel.

The program has already enjoyed considerable success. We have proven the ability of our UREX technology to separate uranium from spent fuel at a very high level of purity and also shown that a derivative, UREX+, can separate a combined mixture of plutonium and neptunium that can serve as the basis for a proliferation-resistant fuel for light water reactors.

The Department's research efforts are leading to the demonstration of proliferation-resistant fuel treatment technologies to reduce the volume and radioactivity of high level waste, and the development of advanced fuels that would enable consumption of plutonium using existing light water reactors or advanced reactors. We have tested proliferation-resistant nitride and metal transmutation fuels in the Advanced Test Reactor and are currently testing mixed-oxide fuels such as would be derived from the UREX+ process.

For the Advanced Fuel Cycle Initiative to be successful, advanced fuel treatment and transmutation research and development must be integrated with the development of Generation IV nuclear energy systems, particularly with those reactor technologies that can produce very high energy neutrons that would be needed to transmute a wide variety of toxic radioactive species. We have organized our national labs, universities, and international collaborations in a manner that will enable this work to proceed in a coordinated manner.

NUCLEAR POWER 2010

The President's Budget supports continuation of Nuclear Power 2010 in FY 2005 to demonstrate, in cost-shared cooperation with industry, key regulatory processes associated with licensing and building new nuclear plants in the U.S. by the end of the decade. The requested funds of \$10 million would support the activities associated with achieving NRC approval of early site permits and the development of Combined Construction and Operating License applications.

It is also critical that the Department identify the business conditions under which power generation companies would add new nuclear capacity and determine appropriate strategies to enhance such investment. In FY 2005, the Department will continue to evaluate and develop strategies to mitigate specific financial risks associated with the deployment of new nuclear power plants.

In December, the Department issued a solicitation inviting proposals from teams led by power generation companies to initiate New Nuclear Plant Licensing Demonstration Projects. Under these cost-shared projects, power companies will conduct studies, analyses, and other activities necessary to select an advanced reactor technology and prepare a site-specific, technology-specific Combined Operating License application. These projects will provide for NRC design certification and other activities to license a standardized nuclear power plant design. The Department expects to award at least one project in this fiscal year. The focus of activities in FY 2005 for these projects will be on development of the Combined Operating License application.

UNIVERSITY REACTOR FUEL ASSISTANCE AND SUPPORT

The Department is very pleased with the progress we have made in reversing the decline in nuclear engineering in the United States. With significant support and encouragement from this body and your colleagues in the House of Representatives, we have played a large role in completely reversing the decline in undergraduate enrollments in this area of study that began in 1993 and continued through 1998. In 1998, the U.S. saw only around 500 students enroll as nuclear engineers—down from almost 1,500 in 1992. After several years of focused effort, the United States now has over 1,300 students studying nuclear engineering. That number is set to increase further, as strong programs—such as at Purdue and Texas A&M—continue to grow and we see new programs start at schools such as South Carolina State University, the University of South Carolina, and the University of Nevada-Las Vegas.

The growth of nuclear energy in the United States is dependent on the preservation of the education and training infrastructure at universities. The research conducted using these reactors is critical to many national priorities. Currently, there are 27 operating university research reactors at 26 campuses in 20 states. These reactors are providing support for research in such diverse areas as medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion and food irradiation.

The most exciting development in University Reactor Infrastructure and Education Assistance is the Innovations in Nuclear Infrastructure and Education (INIE) Program

established in FY 2002. In FY 2003, two additional university consortia were awarded, bringing the total to six INIE grants, providing support to 24 universities in 19 states across the Nation. The consortia have demonstrated remarkable collaborative efforts and strong formation of strategic partnerships between universities, national laboratories, and industry. These partnerships have resulted in increased use of the university nuclear reactor research and training facilities, upgrading of facilities, increased support for students, and additional research opportunities for students, faculty and other interested researchers. We are very pleased that the President's Budget includes \$21 million for the University Reactor Infrastructure and Education Assistance program for fellowships, scholarships, nuclear engineering research, and for critical support to university research reactors, all of which will help address this shortage of well-trained nuclear scientists.

We have modified the structure of this program for FY 2005. I am pleased to report that the President's request includes a small but important element to provide scholarships and graduate fellowships to students studying the vital and too-often overlooked discipline of health physics. The Department is concerned that the Nation may soon not have the trained health physicists who are needed to assure the safety of all nuclear and radiological activities. With this budget, we begin building a program to reverse the negative trends in this field as we have already done in nuclear engineering. In another change, we will transfer responsibility for the shipment of spent research reactor fuel to the Office of Civilian Radioactive Waste Management, which is to become the Department's central expertise in the management of spent fuel.

One final note in this regard, Madam Chairman. I am sure that you have noticed that no funding is requested for the Nuclear Energy Research Initiative (NERI) in FY 2005. While this program has successfully spurred U.S. nuclear energy R&D, we believe that the time has now come to integrate the program into our main-stream R&D programs. We will continue to make peer-reviewed NERI awards to university-based researchers who work in areas relevant to our Generation IV, Nuclear Hydrogen, and Advanced Fuel Cycle Initiative programs. With this step, we will engage NERI researchers at universities in the exciting, first-class research we are pursuing in cooperation with countries all over the world.

RADIOLOGICAL FACILITIES MANAGEMENT

This budget request also includes \$69.1 million to maintain critical research, isotope and space and national security power systems facilities at Oak Ridge National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, and Brookhaven National Laboratory in a safe, secure, and cost effective manner to support national priorities.

The FY 2005 budget request also includes \$20.6 million to continue baseline operations and begin construction of the Uranium-233 project at Oak Ridge National Laboratory. This project is aimed at stabilizing materials left over from the Cold War to address a Defense Nuclear Facilities Safety Board recommendation, while extracting isotopes from the uranium that are needed for very promising medical research.

INL – DOE’S COMMAND CENTER FOR NUCLEAR R&D

This budget supports the Secretary’s realignment of the mission of the Idaho National Engineering and Environmental Laboratory to focus the future of the site on nuclear research and development. The Department is in the process of establishing the Idaho National Laboratory, which will combine the resources of the INEEL and the Argonne-West site. As the Department’s leading center of nuclear research and development, a core mission of this laboratory is advanced nuclear reactor and fuel cycle technologies, including the development of space nuclear power and propulsion technologies. The new Idaho National Laboratory will play a vital role in the research and development of enabling technologies for the Next Generation Nuclear Plant, which will support the Department’s long-term vision of a zero-emissions future free of reliance on imported energy.

The Department issued a request for proposals in February to find a management team to reduce costs and build expertise at the INL. The Department’s nuclear energy program involves the collective talents of universities, the private sector, international partners and many of our other national laboratories – Argonne, Los Alamos, Sandia and Oak Ridge among them. However, the rebuilding of the Department’s nuclear power research and development program will be centered at INL. While environmental cleanup remains an important focus at the Idaho site, real progress is being made that will aid in the expansion of nuclear research and development.

Developing a central research laboratory is a major step forward for the nuclear energy program. We will join the other key energy programs at the Department by having a central, dedicated research site at which we can centralize our infrastructure investments and build the expertise needed to accomplish our program goals. A central lab also helps us minimize the shipment of nuclear materials across the country and allows us to bring our nuclear materials together in a single, secure location. We also expect that our new lab will become a major player in the education of the next generation of nuclear energy technologists that this Nation will need to assure our energy security in the future.

CONCLUSION

This concludes my prepared statement. Your leadership and guidance has been essential to the progress the program has achieved thus far and your support is needed as we engage the tasks ahead.

I would be pleased to answer any questions you may have.